

Genetics in *Harry Potter's* World

Lesson 1

Phenotypes & Genotypes

Dominant & Recessive Traits

Punnett Square

Genetics in *Harry Potter*?

What types of inherited genetic traits are described in the *Harry Potter* series?

Inherited Physical Traits in *Harry Potter*

*"All the Weasleys have red hair, freckles,
and more children than they can afford."*

-- Draco Malfoy (Sorcerer's Stone, Ch.6)

*He was almost twice as tall as a normal
man and at least five times as wide.*

(Sorcerer's Stone, Ch.1)

*Harry had a thin face, knobby knees,
black hair, and bright green eyes.*

(Sorcerer's Stone, Ch.1)

*A pale boy with a pointed face and white-
blond hair, Draco greatly resembled
his father. His mother was blonde too...*

(Goblet of Fire, Ch.8)

Applying Genetics to the *Harry Potter* Characters

What are some **phenotypes** (observable traits) described in the four excerpts from the *Harry Potter* books?

Applying Genetics to the *Harry Potter* Characters

What are some **phenotypes** (observable traits) described in the four excerpts from the *Harry Potter* books?

Freckles, Hair color, Eye color, and Height

Applying Genetics to the *Harry Potter* Characters

A genetic trait can be described in two ways:

Phenotypes are observable traits resulting from how one's genes are expressed. Ex., hair color, a talent, sickle cell disease, etc.

A **Genotype** consists of two letters that represent a gene's allele pair that results in a phenotype.

Example: Freckles

Two possible **phenotypes** for freckles are:

Has Freckles (observable)

No freckles (observable)

A **genotype** for freckles is indicated by two alleles in the freckle gene. The possible alleles using the first letter of the trait “f” are:

F (dominant) = **Has Freckles**

f (recessive) = **No freckles**

Question: Using **F** and **f**, what are possible **genotypes** of the allele pair for freckles?

Freckles: Genotypes & Phenotypes

Question: Using **F** and **f**, what are possible **genotypes** of the allele pair for freckles?

Genotype

(alleles inherited from parents)

F F

F f

f f

Phenotype

(physical appearance)

has freckles

has freckles

no freckles

One dominant allele (**F**) is sufficient for its trait (has freckles) to be observable, but both alleles have to be recessive (**f**) for the recessive trait (no freckles) to be observable.

Example: Red Hair

Red hair color is **recessive** to brown color. One way to describe the hair color alleles are:

Red hair = **r** (notes recessive red color)

Brown hair = **R** (notes dominant brown color)

Question: Using **r** (red hair) and **R** (brown hair) alleles, what possible **genotypes** of the allele pair are there?

Genotype (allele pair)

Phenotype (appearance)

Example: Red Hair

Question: Using **R** (brown hair) and **r** (red hair) alleles, what possible **genotypes** of the allele pair are there?

Genotype (allele pair)

RR

Rr

rr

Phenotype (appearance)

brown hair

brown hair

red hair

Punnett Square: Heredity Prediction Diagram

Punnett Square: Freckles Case 1

Mom has freckles and dad has none. And each parent has a **homozygous genotype** (the two alleles in the gene are the same).

Their **genotypes** are:

Mom = _____

Dad = _____

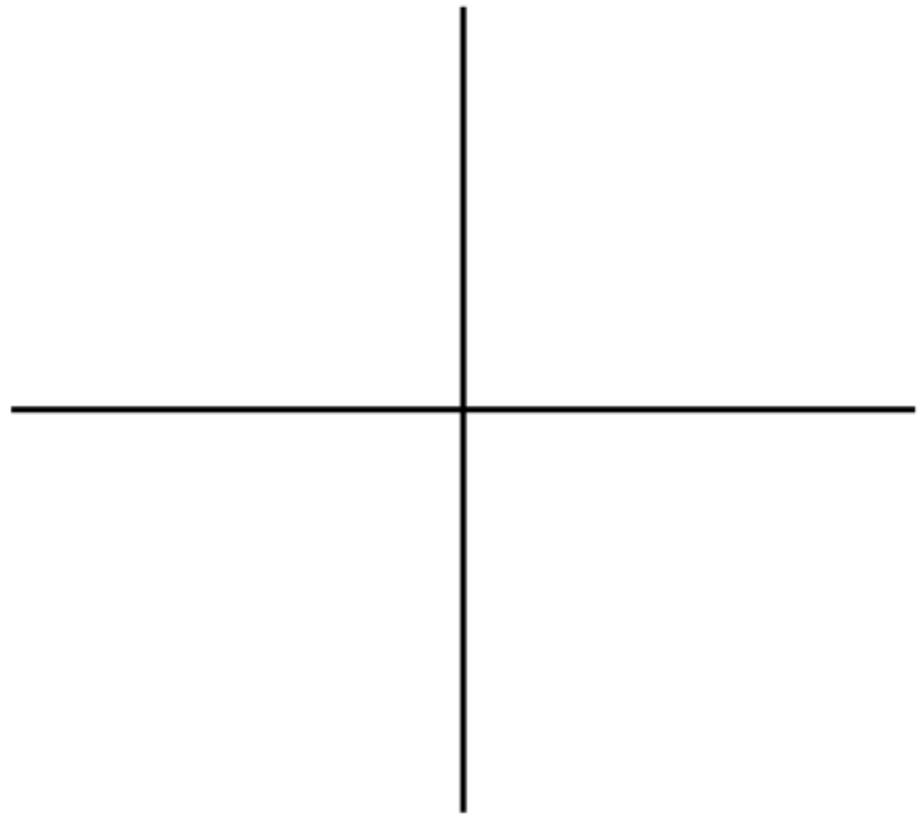
Punnett Square: Freckles Case 1

The parents'
homozygous
genotypes are:

Mom = FF

Dad = ff

Punnett Square



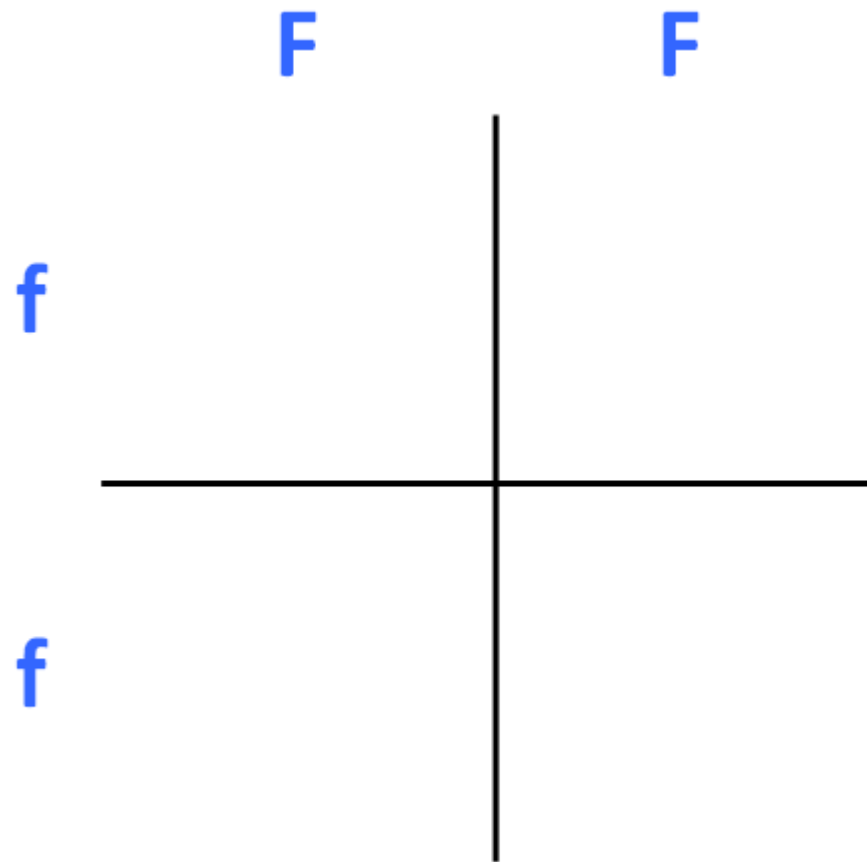
Punnett Square: Freckles Case 1

The parents' **homozygous genotypes** are:

Mom = **FF**

Dad = **ff**

Using the parents' genotypes, each inner square is filled with a possible genotype for their child.



Punnett Square: Freckles Case 1

The parents' **homozygous genotypes** are:

Mom = **FF**

Dad = **ff**

All possible genotypes of their children have a freckle-dominant allele, predicting a 100% chance of their children having freckles.

	F	F
f	Ff	Ff
f	Ff	Ff

Punnett Square: Freckles Case 2

What happens if both mom and dad have freckles whose genotypes are **heterozygous** (the two alleles in the gene are different)?

Their **genotypes** are:

Mom =

Dad =

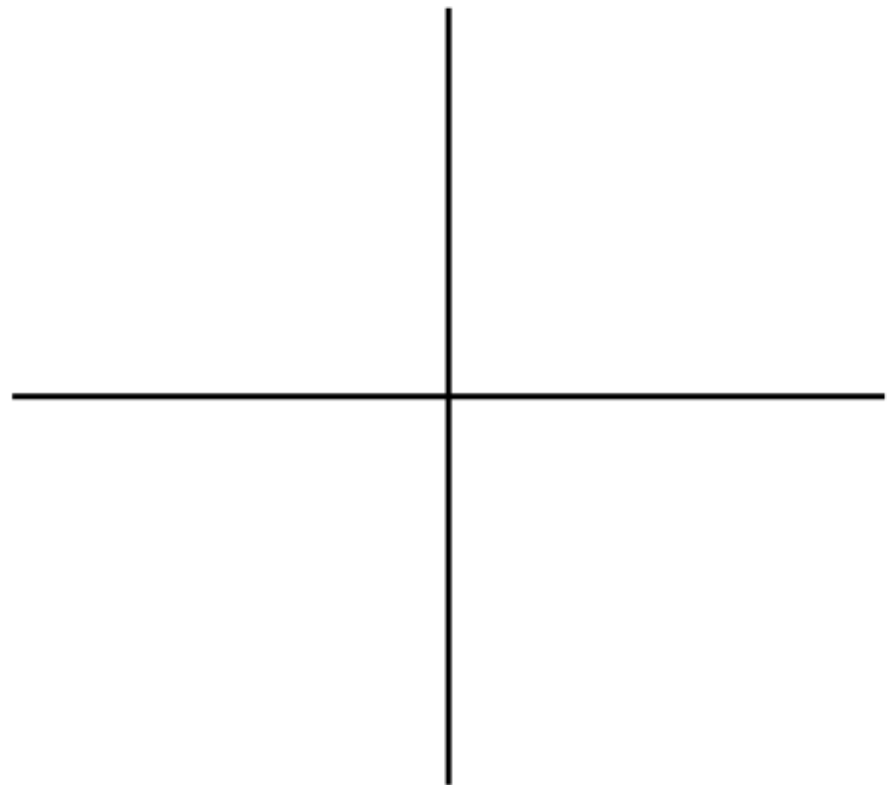
Punnett Square: Freckles Case 2

The parents' heterozygous genotypes are:

Mom = Ff

Dad = Ff

Punnett Square



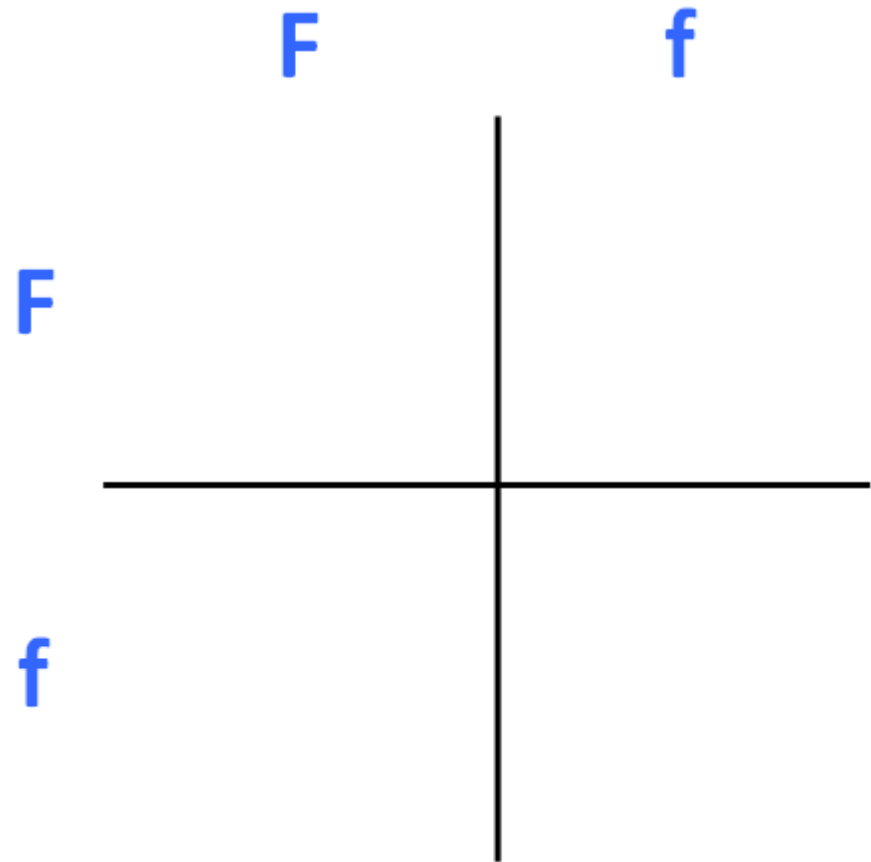
Punnett Square: Freckles Case 2

The parents' **heterozygous genotypes** are:

Mom = **F f**

Dad = **F f**

Using the parents' genotypes, each inner square is filled with a possible genotype for their child.



Punnett Square: Freckles Case 2

The parents' **heterozygous genotypes** are:

Mom = **F f**

Dad = **F f**

There is a 75% probability that their child will have freckles, or a 25% chance of a child with no freckles.

	F	f
F	FF	Ff
f	Ff	ff

Punnet Square: Weasley Family

All Weasley children have freckles and red hair. Use the Punnett Square to predict the most likely genotypes of Molly and Arthur Weasley for the two traits.

Use the following allele possibilities that we identified previously:

- **r** (notes recessive red color) = Red hair
- **R** (notes dominant brown color) = Brown hair
- **F** (dominant) = Has Freckles
- **f** (recessive) = No freckles

Punnett Square: Weasley Family

All Weasley children have freckles and red hair—100% probability. Possible genotypes for their red hair (recessive trait) and freckles (dominant trait) are: **rr** only for red hair and **Ff** or **FF** for freckles. The Punnett Squares show the following genotypes for the children:

Both parents have **rr**.

rr	rr
rr	rr

At least one has **FF**.

Ff/FF	Ff/FF
Ff/FF	Ff/FF

Punnet Square: The Potters

Question 1: Harry has dark/brown hair like his father, but his mom had red hair. Using the genotypes of **rr**, **Rr**, and **RR**, what possible genotypes does each of the Potters have?

Questions 2: Harry marries Ginny who has red hair. What are possible genotypes of their children's hair colors?

Use Punnett Square to demonstrate how you arrived at your answers.

Punnet Square: The Potters

Question 1: Harry has dark/brown hair like his father, but his mom had red hair. Using the genotypes of **rr**, **Rr**, and **RR**, what possible genotypes does each of the Potters have?

The phenotypes of the Potters are:

James Potter (dad)—dark/brown hair

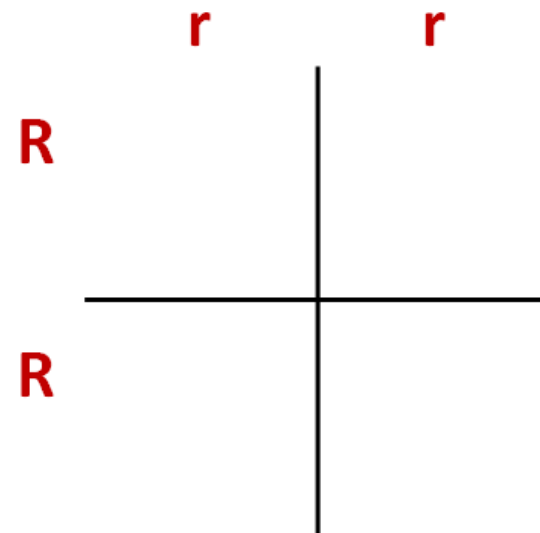
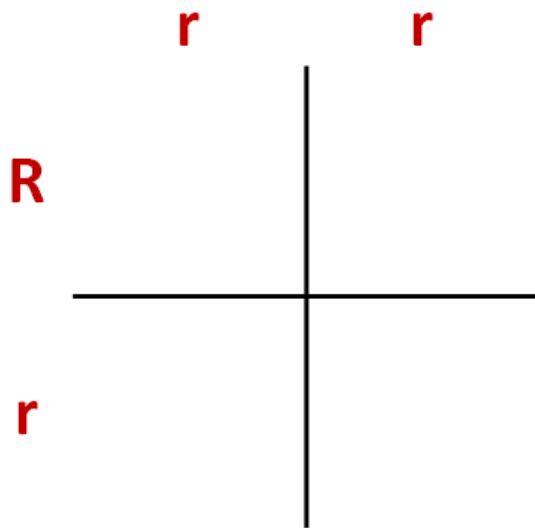
Lily Potter (mom)—red hair

Harry Potter—dark/brown hair

Punnet Square: The Potters

Using the genotypes of **rr**, **Rr**, and **RR**, what are possible genotypes for Harry's parents?

- Mom-Lily (red hair) = **rr**
- Dad-James (dark hair) = **Rr or RR**



The parents' possible genotypes lead to 2 Punnett Squares.

Punnet Square: The Potters

Given Harry's parents' possible genotypes, the two Punnett Squares can be completed as follows:

	r	r
R	Rr	Rr
r	rr	rr

	r	r
R	Rr	Rr
R	Rr	Rr

The **only possible** genotype for Harry's dark hair is **Rr**.

Punnet Square: The Potters

Questions 2: Harry marries Ginny who has red hair. What are possible genotypes of their children's hair colors?

Punnet Square: Harry & Ginny

Harry marries Ginny who has red hair. What are possible genotypes of their children's hair colors?

First, what are the genotypes for Harry and Ginny's hair colors?

Harry's genotype = **Rr**

Ginny's genotype = **rr**

Punnet Square: Harry & Ginny

Harry marries Ginny who has red hair. What are possible genotypes of their children's hair colors?

Given Harry and Ginny's genotypes, **Rr** and **rr**, we can fill in the Punnett Square for their children's genotypes.

Their children have a 50% chance of having red or dark hair colors.

	r	r
R	Rr	Rr
r	rr	rr

Human Mendelian Trait Examples

Trait	Dominant	Recessive
Tongue rolling	Can roll (R)	Can't roll (r)
Freckles	Have freckles (F)	No freckles (f)
Widow's peak	Widow's peak (W)	Straight hairline (w)
Earlobes	Free hanging (A)	Attached (a)
Cleft Chin	Have cleft (C)	No cleft (c)
Hitchhiker's thumb	Hitchhiker's (H)	Straight (h)
Dimples	Have Dimples (D)	Do not have dimples (d)